LIVE CIRCUIT INDICATOR FOR PLUGS AND ~~RECEPTACLES~~CONNECTORS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority pursuant to 35 U.S.C. 119(e) from U.S. Provisional Patent Application having application No. 60/450,961, filed February 28, 2003.

BACKGROUND OF THE INVENTION

1. Field

This invention relates generally to electrical connectors and more particularly to a means for indicating that the contacts of a plug or ~~receptacle~~ connector are electrically connected to a live source of power.

Extension cords, particularly those that are made by a user by connecting a connector and a plug to the ends of a cable having a specific length and sized to carry a maximum current, are typically used both indoors and outdoors to provide electrical power for either a general purpose or a specific use. For example, when used as a general purpose conductor, the extension cord may be used to supply power to a lamp, a portable work light, a power tool, a surge protector such as is used to power a computer, a window mounted air conditioner, etc. When the extension cord is used outside, it may be used to supply power, on a temporary or semi-temporary basis, such as to a boat moored at a boat slip. In each instance, when an extension cord is first connected to a load, the user must usually trace the conductor back to the plug to make sure that it is plugged into a receptacle. However, at this time, the user has no indication that the extension cord is connected to a receptacle that is connected to a live source of power. Therefore, what is needed is a connector, which can also be a plug, that can indicate if it is connected to a

live source of power. Additionally, the connector should look like a standard connector and be wired to a conductor in the same way that a regular connector is wired.

SUMMARY OF THE INVENTION

The present invention relates to a method and apparatus for indicating that the line contacts of a connector are electrically connected to a live source of power. In the invention, a live circuit indicator module has an LED/resistor/diode series circuit connected between the tops of the line contacts of a ~~receptacle~~ connector or prongs of a plug to indicate if the prongs or contacts are connected to a live source of power. In operation, the LED of the series circuit shows by glowing that the prongs of a plug or ~~connectors~~ contacts of a ~~receptacle~~ connector are actually connected to a live source of power.

In this invention, the electrical ~~connector~~device, such as a plug, has at least two blades or prongs for insertion into a receptacle or connector. An electrical cable having at least two line conductors and a ground conductor extends into the housing of the plug and is connected directly to the blades of the plug. A live circuit indicator module is located within the plug for indicating, by means of a light, such as ~~that generated by~~ an LED, that the line prongs of the plug are connected to a live source of power. The housing includes at least one opening located adjacent to the light source located within the plug to provide a visual indication to a user that the prongs are connected to a live source of power. As used herein, the term live source of power is understood to mean that the prongs are connected to a source of potential of, for example, ~~115V,~~ 120V, 240V, more or less, etc.

The module for indicating that the prongs are connected to a live source of power is self contained, can be pre-assembled and is located within the plug to become an integral part of the plug before the prongs of the plug are connected to the electrical line conductors. The series circuit of the live circuit indicator module is electrically coupled to the prongs by means of ~~spring contacts~~ springs which are located in passageways in the module and the back cover to connect the LED/resistor/diode series circuit ~~on~~ in the

module directly to the prongs of the plug. The ~~spring contacts~~ springs extend through the insulating body member of the module ~~on~~ in which the series circuit is located. In operation, when the prongs of the plug are connected to a source of potential, the LED will glow. In the absence of a potential on the prongs of the plug, the LED will not glow. Thus, with this invention, a user can readily determine if power is being applied not just to the plug, but to the blades of a plug by looking for the light in the plug. If the LED is lit, then the prongs of the plug are connected to a live source of power.

The live circuit indicator module does not alter the way the connector (or plug) is wired. A connector (or plug) with the live circuit indicator module, here disclosed, looks the same and is wired the same way as a connector (or plug) which does not have a live circuit indicator module.

The housing of the plug contains alignment means for positioning the light emitting means next to an opening in the cover of the plug to insure that a user can see if the light emitting means is on or off.

With this invention a user can readily determine if power is being applied to the contacts of a plug or ~~receptacle~~ connector by looking for a light in the window of the plug.

This invention has been described in relation to a ~~plug~~ form of electrical connector, it being understood however, that other types of electrical connectors such as electrical receptacles, screw type connectors or any similar form of electrical connector may utilize the live circuit indicator module here disclosed. Further, it is to be understood that this invention can be used with two~~, three or four wire~~ line (hot and neutral) conductor cables for determining if ~~the prongs of~~ a plug or a ~~receptacle are~~ connector is connected to a live source of power.

The foregoing has outlined, rather broadly, the preferred feature of the present invention so that those skilled in the art may better understand the detailed description of the invention that follows. Additional features of the invention will be described hereinafter that form the subject of the claims of the invention. Those skilled in the art should appreciate that they can readily use the disclosed conception and specific

embodiments as a basis for designing or modifying other structures for carrying out the same purposes of the present invention and that such other structures do not depart from the spirit and scope of the invention in its broadest form.

BRIEF DESCRIPTION OF THE DRAWINGS

~~The foregoing and other features of the invention will become apparent upon a consideration of the accompanying drawings forming a part of this specification and in which:~~Other aspects, features and advantages of the present invention will become more fully apparent from the following detailed description, the appended claims and the accompanying drawings in which similar elements are given similar reference numerals.

Fig. 1 is ~~a side elevation partially~~ an exploded perspective view of one form of electrical connector incorporating a live circuit indicator module for indicating if the ~~prongs~~ contacts of a ~~plug~~ connector are connected to a live source of electrical power in accordance with the principles of the invention;

Fig. 2 is a bottom view of the ~~plug~~ connector of Fig. 1 showing the ground ~~prong~~ opening and the two line ~~prongs~~openings;

Fig. 3 is a ~~side elevation~~ perspective view of the back cover of the ~~plug~~ connector which is located above the ~~prongs~~ contacts of the ~~plug~~ connector and below the live circuit indicator module;

Fig. 4 is a top view of the live circuit indicator module showing the series circuit for indicating if the ~~prongs~~ contacts of the ~~plug or~~ connector are connected to a live source of electrical power;

Fig. 5 is a ~~side elevation~~ perspective view of the cover of the top portion of the ~~plug~~connector;

Fig. 6 is a ~~side elevation~~ perspective view of the lower portion or body of the ~~plug~~ connector showing spring contacts about to be placed into passageways in the back cover

to make electrical contact with the tops of the line ~~prongs~~ contacts that are to be connected to line conductors;

Fig. 7 is a ~~side elevation~~ perspective partially exploded view showing how the live circuit indicator module fits on the top of the back cover;

Fig. 8 is a ~~side elevation~~ perspective view of the body of the ~~plug~~ connector including the live circuit indicator module ready for positioning within the cover; and

Fig. 9 is an exploded ~~elevation~~ perspective view of the body of the plug showing the two ~~contact spring~~ springs about to be inserted into ~~the~~ openings in the back cover to provide a conductive path between the prongs of the plug and the circuit ~~on~~ in the live circuit indicator module.

DETAILED DESCRIPTION

FIG. 1 shows ~~a partially~~ an exploded perspective view of one form of an electrical connector within which is a live circuit ~~detector~~ indicator module for indicating the presence of electrical power at the ~~prongs of a connector such as a plug~~ contacts in accordance with the principles of the invention. The ~~plug~~ connector 10 has a cover 12 adapted to be positioned over the top ~~portion of the plug 10~~ and secured firmly to the body 16 with screws 24. The ~~plug~~ connector supports a pair of ~~prong or~~ line ~~blade~~ contacts and a ground contact ~~blade~~ (not illustrated). ~~which extend~~ In the case of a plug, prongs extend outward from the bottom surface of the plug to provide a standard three blade grounded plug. Power is supplied to the plug or connector by a three wire ~~conductor~~ cable (not illustrated) having two line conductors and a ground conductor which extend into the cover and connect to the line contacts/blades and the ground contact/blade. A clamping means is provided to hold the three wire ~~conductor~~ cable in position relative to the ~~plug 10~~ connector.

In accordance with the principles of invention, at least one window opening 14 is provided in the cover 12. The window extends into the hollow interior of the cover. A

light generating means such as an LED located ~~on~~ in a live circuit ~~detector~~ indicator module is positioned behind the window and is visible through the window opening 14.

The wires of the conductor are stripped of insulation at the ends and are inserted into the openings 30 for attachment to the ~~prongs~~ contacts of the ~~plug~~connector. The inward end of each ~~prong~~ line contact includes a connection screw and a clamp assembly for securing a conductive lead wire in electrical contact with the ~~prong~~contact. In a similar manner, the inward end of the ground contact ~~blade~~ includes a screw and clamp assembly for connecting a ground lead wire thereto. Insertion of the wires into openings 30 and clamping the wires to the ~~prongs~~ contacts electrically connects each wire to a ~~prong~~ contact of the ~~plug~~connector.

Referring to Fig. 2, there is illustrated a bottom view of the ~~plug~~ connector of Fig. 1 showing three ~~prongs where prong 16~~ openings. Behind opening 17 is the ground contact and ~~prongs~~ behind openings 18 and 20 are the line contacts. Three screws 24, see Fig. 1, extend from the bottom surface through the body 16 of the ~~plug~~ connector to engage the cover 12. Tightening the screws 24 locks the cover 12 to the body 16 where the lower edge 26 of the cover engages the upper edge 28 of the body of the ~~plug~~connector. Alignment means is provided to align the cover with the body~~;~~ and the window in the cover with the LED of the live circuit indicator module.

When the cover is positioned over the top portion of the body, ~~the~~ live circuit ~~detector~~ indicator module 40 and back cover 50 of the plug are located within the cover (Fig. 1).

Fig. 3 is a ~~side elevation~~ perspective view of the back cover 40 of the ~~plug~~ connector. The openings 30 are sized to receive the conducting wires of the cable which supplies power to the ~~prongs~~ contacts of the ~~plug~~ connector. The back cover has two passageways for receiving springs ~~contacts~~. The openings are positioned to be in alignment with the top of the ~~blades~~ connector which ~~are to be~~ is connected to the line conductors and with the ~~clip contacts~~conductive pads 52, 54 (see Fig. 4) of the LED/resistor/diode circuit located ~~on~~ in the live circuit indicator module when the live circuit indicator module is positioned onto the top of the back cover.

Referring to Fig 4, there is shown the top view of the live circuit indicator module 40. The module has three openings 56 sized to receive the projections 58 (see Fig. 3) into which the conducting wires of the cable are located. Located on the top surface of the module 40 is the series circuit for detecting the presence or absence of power at the prongs contacts of the plugconnector. The circuit comprises a conductive pad 52 connected to a diode 58, which can be an IN40D5;, an LED 60;, a resistor 62 which can be a 1/4 watt 30K ohms; and a second conductive pad 54, all connected in series. The LED is positioned to be aligned with and located behind the window 14 in the cover when the plug connector is assembled. The pads 52, 54 are positioned to be in alignment with the top of the passageways in the back cover which contain the springs contacts. When the live circuit indicator module is positioned on top of the back cover, the conductive pads 52,54 make electrical contact with the tops of the two prongs contacts connected to the line conductors by means of contact springs located within the openings in the back cover. Thus, a series circuit is established from the top of one line connected prong contact through pad 52, diode 58, LED 60, resistor 62, and pad 54 to the top of the other line connected prongcontact.

In operation, the LED is on when power is applied to the line connected prongscontacts, and the LED is off when the line connected prongs contacts are not connected to a live source of power. Thus, with this invention, a break in either of the line conductors, even at the very top of the prongs will be indicated by the on off state of the LED.

Referring to Fig. 5 there is shown a side elevation perspective view of the top portion of cover 12 of the plug or connector. The cover contains a window 14 which is aligned to allow light from the LED to pass through for viewing by a user. A clear or colored lens can be positioned in the opening to prevent moisture and dirt from entering the interior of the plug and better allowing a user to see if the LED is on or off. If desired, the lens can be colored green or red or another color to emphasize the state of operation (conductivity) of the plug or connector. The top of the cap cover supports a cable clamp to prevent the conductive cable from being pulled out of the plug.

Fig. 6 is a ~~side elevation~~ perspective view of the body of the ~~plug~~ connector without the ~~line~~ live circuit indicator module and the cover and showing the two springs ~~contacts 62~~63~~,64~~. Springs ~~contacts 62~~63~~, 64~~ are located in the passageways 65 of the back cover to electrically connect the conductive pads 52, 54 to the tops of the ~~prongs~~ contacts of the ~~plug~~ connector that are connected to the line conductors.

Fig. 7 is a ~~side elevation~~ perspective partially exploded view showing the live circuit indicator module about to be positioned on the top of the back cover. The back cover and the live circuit indicator module have alignment means to insure that the springs ~~contacts 62~~63~~, 64~~ make electrical contact with the tops of the ~~prongs~~ contacts of the ~~plug~~ connector that will be connected to the line conductors. The same or another alignment means also insures that the LED will be in alignment with and located behind the window in the cover when the cover is attached to the body of the ~~plug~~ connector to permit light from the LED to be seen by a user.

Fig. 8 is a ~~side elevation~~ perspective view of the body of the ~~plug body~~ connector showing the live circuit indicator module in position on top of the back cover. The live circuit indicator module can be heat staked to the back cover or held in place by screws, epoxy or the like.

Fig. 9 is an exploded ~~elevation~~ perspective view of the body of the plug showing the two ~~contact~~ springs ~~about to be~~ prior to being inserted into the passageways in the back cover to make contact with the tops of the prongs which are to be connected to the line conductors. Thereafter, the ~~line~~ live circuit indicator module is placed on top of the back cover and, by means of alignment means, the conductive pads 52, 54 are located to make contact with the tops of the springs ~~contacts~~ to electrically connect the series circuit ~~on~~ of the live circuit indicator module across the two prongs of the plug which are to be connected to the line conductors.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to the preferred embodiment, it will be understood that various omissions and substitutions and changes of the form and details

of the method and apparatus illustrated in the operation may be done by those skilled in the art, without departing from the spirit of the invention.

ABSTRACT

An electrical connector, such as one for receiving a plug, having at least two prongs for insertion into ~~a receptacle~~ the connector, and having an electrical cable connected to the prongs of the plug and the connector in the usual way, includes a series circuit having an LED. The LED is located within the connector behind a window, and light from the LED provides a visual indication to a user that the ~~prongs are~~ connector is connected to a live circuit. The series circuit is located ~~on~~ in a module that can be pre-assembled before being located within the connector and, when in the connector, the series circuit is electrically coupled directly to the ~~prongs~~ contacts in the connector by means of spring contacts located in passageways in the module. Indexing means is provided for aligning the LED ~~on~~ in the module with the window in the connector to insure that a user can see if the LED is on or off.